Combined Charging System
ONE SYSTEM FOR ALL

Albrecht Pfeiffer, BMW Group
Ralf Noha (Axel Willikens), Daimler
Sönke Detlefsen, Volkswagen AG
Cornel Pampu, Carmeq GmbH

EVS 28
KINTEX, Korea, May 3-6, 2015
Combined Charging System
One system for global e-Mobility

Start of e-Mobility
Regional, mutually incompatible solutions

Global e-Mobility
Combined Charging System with AC and DC charging

User friendly
Safe
Compact
Future-proof
Combined Charging System

Open, standardized and future-proof charging system

Integrated communication for charge control and value added services

Common charge topology for AC and DC

Single vehicle inlet for all charge scenarios

Comprehensive safety measures for all charging scenarios

Coordination Office Charging Interface
c/o Carmeq GmbH

Audi

DAIMLER

PORSCHE

Volkswagen
Combined Charging System

Definition

**AC**
- Type 2 Plug* (IEC 62196-2)

**DC**
- Combo 2 Plug* (IEC 62196-3)

---

**Communication Standard**
- ISO/IEC 15118, DIN Spec 70121

* In Europe; in US Type 1 / Combo 1 respectively

**Charging Duration**
- **Normal**
  - AC 1-3 ph: 3.7 kW (8 h), 11 kW (1 h), 22 kW (1 h), 43 kW (1 h)
  - DC: 10 kW (1 h), 20 kW (1 h), 50 kW (1 h), 100 kW (15 min), 150 kW (15 min), 200 kW (15 min), 350 kW (15 min)

Coordination Office Charging Interface
c/o Carmeq GmbH
Combined Charging System

Core Features based on market-proof technology

Safety features

- Diagnosable lock
- Proximity and control pilot

Combined Inlet

1. 1-phase AC charging with Type 2*
2. Integration into smart grid
3. 3-phase AC charging with Type 2*
4. High power DC charging via dedicated pins with Combo 2*

Function

<table>
<thead>
<tr>
<th>AC 1-3 ph</th>
<th>3.7 kW</th>
<th>11 kW</th>
<th>22 kW</th>
<th>43 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charging Duration</td>
<td>Normal</td>
<td>8 h</td>
<td>1 h</td>
<td>Fast 15 min</td>
</tr>
</tbody>
</table>

| DC | 10 kW | 20 kW | 50 kW | 100 kW | 150 kW | 200 kW | 350 kW |

* In Europe; in US Type 1 / Combo 1 respectively
The CCS with:

- **IDENTICAL** safety measures (e.g. PWM)
- **IDENTICAL** charging communication (PLC)

covering **ALL** charging scenarios worldwide

* In Europe; in US Type 1 / Combo 1 respectively
Implementation of CCS – Public Transport

Battery concepts for 12m electric city buses

Small battery (~85 kWh)

- Fully charged at bus stops with high power (400-500 kW).
- Fully charged over night with low power (20 kW).

Large battery (>200 kWh)

- Recharged with medium power at final stops (50-100 kW).
- Fully charged over night in the bus depot.

Both battery charging concepts require a power range of 20-100 kW
Implementation of CCS – Public Transport

Charging at Bus Depot

- Full and grid- & battery-friendly charging over night with low power (20 kW).

- Full and battery-friendly charging over night with medium power (~ 50 kW).

CCS chargers: Flexible and cost-efficient.
Combined Charging System

VALIDATED AND ON THE MARKET

Coordination Office Charging Interface
c/o Carmeq GmbH
# Ideas Turned into Reality

<table>
<thead>
<tr>
<th>Design</th>
<th>Series</th>
<th>Realization</th>
<th>Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Design Image]</td>
<td>![Series Image]</td>
<td>![Realization Image]</td>
<td>![Diagnostics Image]</td>
</tr>
</tbody>
</table>

## Time

- **EVS26 - Los Angeles, USA**  
  07.05. – 09.05.2012

- **eCarTec - Munich, Germany**  
  22. – 24.10.2012

- **Angela Merkel charging an VW e-up!**  
  International Conference E-mobility Berlin

- **GM ATC – Torrance, CA**  
  GM operating an AkerWade DC 50kW unit

- **BMW of NA – Woodcliff Lake, NJ**  
  BMW i3 operating an ABB DC 50 kW unit

- **VW ERL - Belmont, CA**  
  VW operating an Eaton DC 50 kW unit
Coordination Office Charging Interface
c/o Carmeq GmbH

Support of Combined Charging System

Adoption of EU „clean fuel strategy“ earlier this year:
- „Type 2“ and „Combo 2“ as common standard for the whole of Europe
- Starting 2017: CCS obligatory component of newly installed EVSEs

All members of the European Association of Automotive Manufacturers (ACEA) are committed towards Combined Charging System
Successful Market Introduction – Infrastructure
Roll-out well under way - US & EU
Status charging Systems in Korea

General Recommendations for Deployment in Korea

- CCS Type 1 connector for AC-charging => CCS Combo 1 connector for DC charging
- No modifications of IEC Standards to meet local requirement

Coordination Office Charging Interface
c/o Carmeq GmbH
THE DRIVING FACTORS
Changing Values in Society

Charging

Mobility

Routine 2.0

Time

Coordination Office Charging Interface
c/o Carmeq GmbH
Enabling Fast Charging Infrastructure

Benefits

EXTEND OPERATING RANGE

EVs & CHARGING INFRASTRUCTURE

SHOP & CHARGE

Rent eCar HERE

Coordination Office Charging Interface
c/o Carmeq GmbH

Audi  BMW  DAIMLER  PORSCHE  VOLKSWAGEN
The Combined Charging System
SAFE, UNIVERSAL, OPEN, ROBUST, INNOVATIVE SYSTEM FOR E-VEHICLES

Mature Standards
Compelling Design
Future Proof
Nationally & Internationally Validated

Coordination Office Charging Interface
c/o Carmeq GmbH